REMARKS:

STATEMENT OF STATUS AND SUPPORT FOR ALL CHANGES TO THE CLAIMS
37 CFR 1.173(c)

The Examiner has requested that a statement of the status of all patent claims and of all added claims be submitted on a page separate from the pages containing the changes. Although such a statement was included on page 13 of the amendment submitted on June 13, 2005, the Applicant submits an updated statement out of an abundance of caution.

The Applicant submits that patent claims **1-29** are pending in this reissue application as of the date of this amendment.

The Applicant submits that claims **30-36** and **39**, which have been added in this reissue application, are pending in this reissue application as of the date of this amendment.

The Applicant submits that claims **37** and **38** which had been previously added in this reissue application have been canceled.

Support for the previous amendments to claim **1** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **6** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **10** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **13** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **14** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **18** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **19** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **20** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **21** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **22** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **23** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **24** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **25** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **26** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **27** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **28** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **29** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **30** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for the previous amendments to claim **34** can be found in the specification at col. 3, lines 23-38 and at col. 6, lines 41-54.

Support for newly added claim **39** can be found FIG. 3J and in original claims **19-29**.

CORRECTED DECLARATION

The Applicants appreciate the Examiner's acceptance of the corrected declaration submitted with the amendment of June 13, 2005.

CLAIM OBJECTIONS

The Examiner has objected to claims 1-36 and 39 because of informalities. In response the Applicant submits herewith a revised version of the claims as amended on June 13, 2005, with brackets for all deleted material and underlining for added matter including all of claims 30-36 and 39. Canceled claims 37 and 38 are presented without presentation of the text. In addition, the Applicant submits herewith the above Statement of Status and Support for all Chances to the Claims. The Applicant believes that the objections are overcome.

CLAIM REJECTIONS

35 USC 251.

The Examiner has rejected the Applicants arguments that claims **30-38** are not an improper recapture of broadened claimed subject matter. The Applicant has argued that there has been no recapture since the broadening aspect present in claims **30** and **34** relates to features that were not surrendered during prosecution. Specifically, claims **30** and **34** seek to remove the feature:

> "said optical fiber having an end section that extends through the fiber socket, said optical fiber terminating at an end face situated approximately adjacent to the second layer, said fiber socket aligning and positioning said optical fiber therein".

This feature was in the claims as originally filed in the application which issued as the patent for which reissue is being sought.

This subject matter was not added during the original prosecution in any attempt to overcome a prior art rejection. Instead, this subject matter was part of the claims as originally filed. During prosecution of the original application, other features were added to the claims following prior art rejections. The Applicant filed a continuation application seeking to obtain the originally claimed subject matter. The Examiner has argued that the filing of the continuation has no effect on the issue of recapture. However, the Examiner has cited no law, rule, legal decision, MPEP section or fact tending to support this position.

Furthermore, the Applicant submits that the Federal Circuit disagrees with the Examiner's position. In a case that has been cited by the Examiner, the Federal Circuit has specifically held that with regard to recapture "[d]eliberately canceling a claim in an effort to overcome a reference...is not dispositive because other evidence in the prosecution history may indicate the contrary." (see *in re Clement* 131 F.3d at 1469, (Fed. Cir. 1997)). In a footnote immediately following this statement it is specifically stated that, "if an applicant amends a broad claim in an effort to distinguish a reference and obtain allowance, but promptly files a continuation application to continue to traverse the prior art rejections, circumstances would suggest that the applicant did not admit that broader claims were not patentable — assuming that the applicant does not ultimately abandon the continuation application because the examiner refuses to withdraw the rejections." (see footnote to *in re Clement 131 F.3d at 1469*). A copy of the relevant page of the *in re Clement* decision is attached herewith for the Examiner's convenience.

The Applicant submits that the exact same factual situation cited in the footnote to *in re Clement* exists in the present application. To underscore the Applicant's point, the Applicant submits that claim 1 in the original application (09/327,826) read as follows as originally filed:

> 1. A multilayer optical fiber coupler for coupling optical radiation between an optical device and an optical fiber, comprising:
> a first layer, said first layer defining a fiber socket formed by photolithographic masking and etching to extend through said first layer, said fiber socket sized to receive and align said optical fiber therein;
> a second layer bonded to said first layer;
> said optical fiber having an end section that extends through the fiber socket, said optical fiber terminating at an end face situated approximately adjacent to the second layer, said fiber socket aligning and positioning said optical fiber therein.

Claim 30 seeks to remove the word "photolithographic", add the words <u>deep reactive ion</u> before "etching" and remove the clause contained in the last three lines.

The Applicant submits that in the present case, claims 1-4, 11-14 and 21 in the original application (09/327,826) were rejected in an Office Action dated January 29, 2001. Claims 1, 11, 14 and 21 were cancelled <u>without prejudice</u> in an amendment dated May 29, 2001.

In particular, claim 1 was amended to add the underlined material:

1. A multilayer optical fiber coupler for coupling optical radiation between an optical device and an optical fiber, comprising:
a first layer, said first layer defining a fiber socket formed by photolithographic masking and etching to extend through said first layer, said fiber socket sized to receive and align said optical fiber therein;
a second layer bonded to said first layer;
said optical fiber having an end section that extends through the fiber socket, said optical fiber terminating at an end face situated approximately adjacent to the second layer, said fiber socket aligning and positioning said optical fiber therein; and wherein said second layer has an index of refraction substantially equal to the index of refraction of the core of said optical fiber.

On November 26, 2001, U.S. Patent Application 09/995,214 was filed as a continuation of Application 09/327,826. Claim 1 of application 09/995,214 was nearly identical to claim 1 of the parent application 09/327,826. Furthermore, claims 7, 8, 11, 14 and 15 of application 09/995,214 corresponded to claims 6, 7, 10, 13 and 14 of U.S. application 09/327,826. In addition, application 09/995,214 contained method claims 19-31 corresponding to claims 21-33 of application 09/327,826. U.S. Patent Application 09/995,214 issued as U.S. Patent 6,527,455 on March 4, 2003. The Applicant submits that documentary support for these facts can be found in the official file histories for US Patent Applications 09/327,826 and 09/995,214.

Thus, although claims 1, 11, 14 and 21 of application 09/327,826 were cancelled, the Applicant promptly filed a continuation application directed to these broad claims and did not ultimately abandon the continuation application. Because original claims 1, 4, 11 and 21 of application 09/327,826 were cancelled without prejudice and promptly pursued in a continuation application that issued as a patent, the Applicant submits that the applicant never admitted that the original claims were not patentable. As such, for the exact same reasons as set forth in the footnote to *in re Clement*, there is no recapture with respect to claims **30-38**. Therefore, the Applicant respectfully requests that the rejections under 35 USC 251 be withdrawn.

Double Patenting

The Examiner has rejected claims **30-36** and **39** under the judicially created doctrine of double patenting over claims 1, and 19 of US Patent 6,527,455. The Examiner indicated that a timely filed terminal disclaimer would overcome the rejections. To expedite prosecution, the Assignee of the present application files herewith a terminal disclaimer in compliance with 37 C.F.R. 1.321(c) along with the appropriate fee. The Applicant submits that the present application and

US Patent 6,527,455 are commonly owned by Arrayed Fiberoptics Corporation. Therefore, the Applicants submit that the rejections are overcome.

35 USC 103

Claims **7-9** and **30-33** were rejected under 35 USC 103(b) as being obvious over US Patent 5,434,939 to Matsuda in further view of US Patent 5,223,914 to Auda (hereinafter Auda). Claims **1-7**, **10-17** and **30-35** and **39** were rejected as being obvious over JP 06-138341 to Konishi et al. in further view of Auda. Claims **18** and **19** were rejected as being unpatentable over Matsuda in further view of EP 0405620 A2 to Kakii in further view of Auda. Claims **20-29**, **36** and **38** were rejected as being obvious over Konishi in further view of Kakii and in further view of Auda. The Applicant respectfully traverses the rejections.

In rejecting the claims, the Examiner admits that Matsuda does not specify an etching process and that Konishi does not teach deep reactive ion etching. The Examiner states that Auda teaches that dry etching technologies such as reactive ion etching are rapidly displacing wet etching technology because dry etching provides precise device fabrication. The Examiner argues that it would have been obvious to use reactive ion etching in Matsuda and Konishi as taught by Auda.

In response, the Applicant notes that Auda does not teach ***deep*** reactive ion etching to form a fiber socket that extends through a first layer as recited in the present claims. Although the Applicant admits that deep reactive ion etching is generally considered a form of RIE etching, *deep* reactive ion etching (DRIE) is very different from traditional RIE and it is this difference that enables the fabrication of sub-micron precision fiber sockets suitable for single mode fiber alignment. Traditional RIE is generally considered by one skilled in the art of semiconductor manufacturing to be a process which is carried out in a vacuum chamber in which several types of gases were flown in and a electromagnetic source is applied to certain electrodes to activate a plasma (see, Silicon Processing for the VLSI Era, Vol. 1 by Stanley Wolf and Richard Tauber, Lattice Press, 1986, hereinafter Wolf et al.). The etching is done through physical etching (energetic ion bombardment) and chemical etching (reactive ions reacting with materials on the substrate and forming volatile compounds which can be pumped away). Ordinary RIE processes are used to etch only a few micron to maybe twenty microns in the extreme case (see Wolf et al.). Typical semiconductor devices such as the Pentium microprocessors are microstructures

built on the surface of the silicon substrate. Even the most advanced silicon transistor structures of today with their six-layer metallization structures normally only span a height of no more than 20 microns above the surface of the silicon wafer (See Wolf et al). Below the silicon surface, the transistors only go into the silicon a few microns at most. Using ordinary RIE processes, it is nearly impossible to form a through hole in silicon which is typically 500 micron thick, let alone a precise and vertical through hole which is required in single mode fiber passive alignment. The traditional RIE process is limited by re-deposition of etched material, which causes three problems. First, at some point the re-deposition self-terminates the etching because etched material is re-deposited material as fast as it is removed. Second, the re-deposition makes is almost impossible to control the shape of the sidewall. Third, since traditional RIE was not designed to etch all the way through a substrate the etch rate is normally much slower. Thus, it would take an unreasonably long time to etch through a silicon substrate, even if there were no problem with re-deposition.

Deep reactive ion etching is a form of RIE etching which was developed in the 1990's to assist the silicon micromachining (MEMS) industry. Contrary to traditional RIE process which barely scratches the surface of the silicon wafer, DRIE processes were designed to shape the bulk of the silicon wafer. A typical DRIE process, uses two rapidly alternating plasma processes (see US Patent 5,501,893 (issued March 26, 1996) to Laermer as referenced in the present application at col. 6, lines 39-54).

By recognizing deep reactive ion etching, which has been developed for the MEMS industry, as a useful tool in fiber optics for etching vertical, precise (sub-micron precision) through holes in silicon for single mode fiber passive alignment, the Applicant's invention:

1) Satisfies a long-felt, long-existing and unsolved need.
2) Succeeds where previously, failure prevailed.
3) Is classified in a crowded art where a small advance carries great weight.
4) Has achieved commercial success.

The invention successfully satisfied a long-felt, long-existing and unsolved need in a crowded filed where a small advance carries great weight and succeeded where, previously, others had failed.

As proof that there was a long-felt, long-existing and unsolved need and previously, others had failed, the Applicant submits herewith a copy of Chapter 9 (Array Device Packaging) of Optoelectronic Packaging, by Nagesh R. Basavanhally, John Wiley and Sons, 1997. The Applicant notes that this reference was published within a year of the filing date of the provisional applications from which the present patent application claims priority. The Authors of this work are top researchers are Lucent Technologies Bell Laboratories. This work can therefore be regarded as representing the state of the art of fiber optic "array device packaging" at approximately the time of the invention. The Examiner's attention is drawn to Table 9-3 on page 159. This table lists the reported results of numerous previous attempts at fiber passive alignment as used in an array. There are two kinds of arrays: linear arrays and two-dimensional arrays. The present invention solves the long felt need for sub-micron precision in passively-aligned two-dimensional fiber arrays. It is noted that Table 9.3 shows that the best alignment accuracy obtainable with passive alignment of 2-D arrays is 2.5 microns. The Applicant notes that the 1.5 micron alignment result was achieved using individual fiber-*active* alignment, which is not passive alignment and therefore does not count. It is further noted that a sub-micron alignment accuracy is required for passive alignment of single-mode optical fibers (see present application col. 1, line 61 to col. 2, line 9).

As proof that the Applicant's invention satisfies a long felt need, the Examiner's attention is directed to Iga, "Stacked Planar Optic: An Application of the Planar Microlens", Applied Optics, vol. 12, No. 19, Oct. 1982, pp 3456-3460 (hereinafter, Iga), which is of record in the present application. This article recognized that a precisely dimensioned hole combined with other optical elements, such as microlens arrays, stacked together can produce many useful fiber optic devices very economically. Therefore, there was a long felt need to solve the problem of single mode fiber passive alignment by making a very precisely dimensioned hole.

However, as shown above with respect to Table 9-3 of Optoelectronic Packaging, the problem of making such a structure had not been solved for at least fifteen years after the problem was first recognized despite numerous efforts by leading researchers in the field. The numerous unsuccessful efforts to produce a passively aligned two-dimensional fiber array with submicron alignment accuracy, as indicated by Table 9-3, show that failure prevailed. The number and variety of efforts by leading researchers at top research institutions throughout the world as

indicated by Table 9-3 also show that this was a crowded field of art where a small advance carries great weight.

The invention has achieved commercial success

The Applicant submits that multilayer optical fiber couplers (fiber arrays) that use fiber sockets formed by deep reactive ion etching (DRIE) are being used commercially with great success. For example, 2D fiber array couplers using DRIE-fabricated fiber sockets are the preferred and in some cases the only type of fiber array coupler that can be used. As a result, they have been widely adopted by several industries and have become the standard approach for these industries including the 3D parallel fiber optic switch industry and the commercial printing industry. The Applicant believes, based on knowledge and experience acquired from being in the fiber optics industry, that all the major manufacturers of 3D parallel fiber optic switches use 2D fiber array couplers using DRIE-fabricated fiber sockets. Specifically, Glimmerglass Networks of Hayward, California, uses 2D fiber array couplers using DRIE-formed silicon fiber sockets (see "The Brilliance^{TM} Behind Glimmerglass' Intelligent Optical Switching" , a copy of which is submitted in the accompanying Information Disclosure Statement (IDS). The first paragraph on page 5 of this reference (entitled "Manufacturing Micro-Photonic Arrays") states that "[t]he key process step for all arrays is deep reactive ion etching (DRIE) of silicon." In addition, Arrayed Fiberoptics Corporation, assignee of the present application, has generated roughly $550,000 per year in revenue from products based on this invention to date.

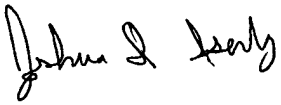
In support of these facts, the Applicant submits herewith, the declaration under 37 CFR 1.132 of Eugene W. Campbell of Glimmerglass Networks Inc, which discusses the use of fiber couplers having DRIE-fabricated fiber sockets in the fiber switch industry. In further support of these facts, the Applicant also submits herewith, the declaration under 37 CFR 1.132 of the inventor Benjamin Jian of Arrayed Fiberoptics Corporation, which discusses the use of DRIE-fabricated 2D fiber arrays for the commercial printing industry. The Applicant submits that entry of these declarations is timely and proper since the reference to Auda had not previously been made of record. Furthermore, the Applicant submits that the adoption of fiber arrays manufactured using DRIE by industry leading optical switch manufacturers shows that the invention as claimed solved the long felt need described above.

In addition, the Applicant submits that Auda is devoid of any teaching or suggestion of using *deep* reactive ion etching. Instead, Auda only teaches the more general art of reactive ion etching. In the absence of such a teaching, the Applicant submits that a prima facie case of obviousness is not present. Furthermore, the distinction between reactive ion etching and deep reactive ion etching as claimed is not trivial. As seen from the preceding discussion of secondary considerations of unobviousness it is deep reactive ion etching that makes possible the formation of fiber sockets suitable for single mode fiber passive alignment.

CONCLUSION

The Applicant submits that all claims are allowable over the prior art and define an invention suitable for patent protection. Furthermore, the Applicant submits that none of the pending claims present an impermissible recapture of subject matter surrendered during prosecution. The Applicants therefore respectfully request that the Examiner enter the Campbell and Jian affidavits, reconsider the application, and point out the allowable subject matter in the next Office Action.

Respectfully submitted,



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